Physics and Metaphysics

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CAMBRIDGE SCHOLARS

PUBLISHING

Physics and Metaphysics,
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This book first published 2011

Cambridge Scholars Publishing

12 Back Chapman Street, Newcastle upon Tyne, NE6 2XX, UK

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

ISBN (10): 1-4438-3297-9, ISBN (13): 978-1-4438-3297-7

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INTRODUCTION

If one wishes firstly to learn properly what he or she is going to read, I must say that the subject treated in this book could be really called philosophy of physics. But if one is not indifferent toward small but sometimes substantial diversity of meanings that words might have, I notice that this philosophy is not of the kind that has a task of philosophical justification of given physical phenomena. Rather I am trying to justify a given philosophy treating accordingly some physical phenomena – just phenomena of physics are presented as reasons to be adduced in order to convince one in soundness of this philosophy.

Good examples of philosophy that was urgent to explain data of experiments that could not be explained within the means of classical physics are interpretations of quantum mechanics. The picture of the world given by classical physics was overturned by new data and physicists and philosophers of physics started to look for different philosophical explanations of the same data described by the same mathematics which, though, turned out to be sharply different from that applied for classical physics. Thus, realism peculiar to classical physics, the realism that seemed natural for it, was abandoned and replaced by positivist concepts keeping within the limits of epistemology, the idea of the plurality of worlds was reinterpreted to conform it to the new physical data, a relativistic postulate was sacrificed in order to overcome quantum mechanical indeterminism and to be able to offer an ontological explanation compatible with classical mechanics; and many other interpretations were given. The interpretations try to explain what quantum mechanics tells us about the world and what its phenomena, which is so different from classical phenomena, may mean. In this sense it is “typical” philosophy of physics. Mostly philosophy of physics tries to answer what phenomena studied in physics tell us: phenomena like laws of thermodynamics, behavior of elementary particles, cosmology, origin of the universe and its possible future development, and so on. Generally speaking, physics might be a solid ground for a philosophical concept to rely on or to start from it – surely fundamental physical problems which are waiting for their solutions are able to open various philosophical perspectives.

As concerns the proposed concept, its physical content is just intended to support a ready-made metaphysics, the metaphysics which says that

things are different even if they look the same or are (or have) to be taken for the same. The peculiar way of classical physics to predict events as derived from special relativity is regarded here mainly from the ontological point of view. Just the ontological concept given here is what is to be valid even if neither the definiteness of predictions nor their statistical nature (nor even any other nature) can have the character of universality but can only be peculiar to a certain kind of objects.

However, possible ways to predict events and hence possible tests that could be deemed sound and reliable for a definite kind of predicted events evidently constitutes a problem for physical research of nowadays. It may be even called a central problem for all-comprehensive theories, for the theories that aim to explain so much that it seems quite impossible to prove within the human forces whether or not those explanations are true. Thus, theories of everything, in particular the famous string theories, which include many unusual concepts, such as the strings that oscillate instead of point-like objects of particle physics, superfluous dimensions over our four dimensions, membranes and so on, have confronted with the problem of testing their concepts. Scientists who are skeptical about these theories point out that it is impossible to falsify the predictions of the theories directly because we cannot reach energies sufficient to test the predictions and, on the other hand, such theories may have so many solutions that reduce higher-energy many-dimensional universes to a lower-energy four-dimensional that any lower-energy phenomena may be accommodated to this higher-energy universe; that is, the theory explains too much to be a scientific theory. The scientists participating in the controversy and taking up this challenge respond in various ways but the problem remains how directly or indirectly the predictions of the theories may be tested and what in these circumstances may be regarded as the reliable testing (though, mostly the theories are just blamed that they cannot be falsified).

Thus, these theories may be regarded (and do really regarded by some) as purely mathematical theories. If no experience can be performed in order to test whether or not they can correspond to physical reality, then they should be considered as mathematical theories describing physical phenomena and their truth or falsity must be reduced to the mathematical correctness as derived from the physical theories they are initially based on.

But as it will be seen, the way of making predictions in classical physics, the character of its predictions, its definiteness, is derived from the mathematics of special relativity; and as it is well-known, the way to predict quantum mechanical statistical phenomena lies in the mathematics that can describe those phenomena. And, apparently, knowing what kind

of predictions is acceptable in a theory, one could better understand which tests can be performed in order to know whether the theory is valid in so far as it has been determined of which character the predictions of the theory must be.

One might conclude from this that once there is a mathematical theory describing physical phenomena (such as strings theories are: comprehensive, claiming to describe all phenomena or a major part of all phenomena), then from its mathematics it must be inferred what kind of predictions it should make – its mathematics itself must indicate how one can predict in that theory as it is the case with quantum mechanics and, as it will be seen, with relativity. In particular, as concerns strings theories or other theories of that kind, since their tests are deemed to be unrealizable from the point of view of the subject who is aware only of the peculiar ways of predictions in classical physics and quantum mechanics, one could try to elucidate the mathematics that determines their peculiar way of predictions (if at all there is any peculiar way in that case) thereby learning what means for them (if at all) to realize the tests to their truth or falsity within their, putatively, peculiar way of making predictions.

Thus, knowing that the way to predict is determined by the same mathematics which describes phenomena of the theory as it is the case with quantum mechanics and relativity, one can make a general statement that any theory is empirical if it contains in itself the indication of the character it is to predict its phenomena. That is, even if direct tests cannot be carried out (say, for technical reasons), this indication, if it exists for a given theory, could be advanced as a criterion whether a theory is empirical or has a "metaphysical" or purely abstract, mathematical character (naturally, a theory which is not comprehensive enough, which is not that general, should not contain such indications, for this indication must be in the theories on which it is based). This philosophical criterion suggests itself if one realizes that relativity and quantum mechanics determine the methods to predict events each in its own way which are not applicable each to the other and if one knows about the problems with the verification of the theories of nowadays physics.

But I must confess that I do not argue such a criterion. It was not my task. And the reasons why it is so are evident. In general, to prove the existence of something is not the same as to prove the necessity of it.
Proving that a given physical theory contains indications to the character of its own predictions one proves the existence, but if one asserts (even without a proof, just as a postulate), for instance, that there is a criterion for empirical theories that requires those indications to recognize them as empirical but not metaphysical or whatever, one actually asserts the

necessity of those indications. I did not go that far. For, as I see it, the existence proof is sufficient for better understanding of the metaphysics, while this kind of a criterion (were it plausible or not) is epistemological one. So, at least on the face of it, the book should contain nothing that says against a possible criterion of that kind, nor is there something here that says in favor of it.

Since the subject of the book is philosophy, but not any empirical science, I act freely while choosing aspects of the consideration. But it would be very distressful for me if one misinterpreted what I called here ”The Ugly Argument” so that the general acceptance and determined propensity for that of which it actually says would be erroneously mistaken for the personal inclinations and preconceptions of the inventors. I do mean nothing of the kind. And such conclusions, if they regretfully could take place, cannot be made from the concepts I hold. I hope it can be clearly seen from Mitjashin (2007). Besides it is evidently impossible to advance or just to consider seriously physical concepts based on certain philosophical views being only influenced (consciously or subliminally) by general opinions and certain social preconceptions (no matter how they might be treated, whether in accordance with the exposed here concepts or not), without instead having corresponding convictions acquired by own self. As concerns that chapter, generally, I believe that my views on the subject (mentality and other matters) at least correspond to the reality and are falsifiable unlike, to my regret, it is the case with many other views on that and related topics.

As I could guess, an exegetical purist might find that some skeptical concepts are treated rather loosely from philosophical point of view; nevertheless the purpose of the book is to elucidate mostly philosophical topics. First of all, it could help in the accepting the metaphysical concept that is maintained here, the concept which makes sometimes questions be arisen, the questions and objections, that I did not ever expect to be arisen because of my negligence and shortage of perspicacity, but that are inevitably to be arisen simply because we are living in the world with the laws of classical physics.

CHAPTER ONE

THE HUME'S PROBLEM

The Hume's problem of induction is known ever since XVIIIth century. It is broadly viewed as the main Hume's contribution and considered by many as the starting point of modern theory of knowledge. This means that the concept of knowledge is deemed to be established upon revealing bounds set on what we can ever know but not upon showing the path which we could tread to pass to better knowledge. Thus, in a sense, for us "to know" means, if we do not care what in particular we are to know, that we must put limits but not that we are to enlarge our scope.

The bounds set on knowledge are represented in the impossibility to justify induction. From the instances having observed we cannot infer their further occurrence. If we know that something appeared, we cannot conclude from that that it is to appear further. However, scientific knowledge, which constitutes the bulk of knowledge of our time, is based mainly (some would say, nearly exclusively) on experience. And if we cannot conclude from the experimental data the independent existence of the phenomenon we have observed in the data – that is, if having the data we cannot guarantee their further iteration – then our knowledge may look like lacking its solid grounds. If there is no justified inductive inference, then the universality of our laws is undermined. Since we cannot infer from the particular to particular, we cannot say that our laws, regularities known from experience, hold universally.

Hume does not put his theory in terms of logical induction. He does not concentrate on inferences, preferring to analyze the connection between the cause and effect. In fact, he does not find this connection. There is nothing special in what happens between something that is called a "cause" and something that is called the "effect", which might be their connection; there is no link between the things in their interaction – what there is is only those things in their interaction.

Suppose, Hume says, we observe that a ball hits another ball and makes the latter one move. All that we can infer from the observation is that, literally, a ball hits the other and the latter moves. We cannot infer from

that that the ball has a power or contains an impetus to make the other ball move. We can assert only that the ball hits the other ball and it moves. This does not allow us to conclude that the second ball's motion is the effect of its hitting by the first ball. Seeing two balls' collision, we cannot infer that the motion of a ball was caused by its clash with the other. But we can only state that the motion of the ball follows after its touch with the other ball. We see that the ball moves after it was hit, but we do not see that its motion was the effect whose cause was its hitting by the other ball. All we see is the sequence of events and nothing in our observations could prompt us to assert that one event is the cause and another event is its effect, we can assert only that one event follows after another.

Suppose a murder, Hume says. If we happen to be its witnesses, we can see the corpse, blood, wounds, we can hear the evidences given, cries and so on, but we cannot observe vice in it, we cannot observe what should be the cause of a murder. We can observe events following one after another, but we cannot observe that one event is the cause and another is the effect. We see the sequence of events but not the link between the events of the sequence, the events following one after another but not a cause generating an effect.

All our conclusions from experience are based on a certain similarity of the events following one after another but not on something that is beyond our senses, not on a certain nexus between the cause and effect. Simply there is no such a nexus, at least that which is given in our senses. The particular does not *follow* from the particular. The particular can only *succeed* the particular. We cannot see any cause and effect in the succession of events and cannot conclude that a particular event impels appearance of another particular event.

Someone who is put into the world where objects continually follow one after another and who is endowed with good sense, memory and faculty of reflection nevertheless can by no means discern anything that makes objects be in succession. He can make out no secret power behind that succession, nothing that is able to bring him an idea of cause or effect that makes one object be a successor of another can ever appear to his senses. But if he remains in that world sufficiently long, though never perceiving the secret powers behind the succession, he notices that objects are conjoint together in specific ways. And there appears something that makes him draw from experience that things are so-and-so connected, something in which, as he knows, his understanding does not participate. Hume asserts that what makes us conclude from experience that a certain object succeeds another and makes us expect that a particular object is to follow another is nothing but custom. If we connect one event and another

event which follows the former, we do it by custom only, but not for any other reason.

Nothing can urge us to conclude from experience that an event that follows another event is that which is made appear by the first event. If we see that a ball hit another, we cannot ascribe its motion to a certain power of the ball that hit it. From the fact that an event follows another event does not follow that this event is that which follows the other event. Once an event follows another, it does not mean that a similar event will follow after another event, similar to the other. That is, once an event follows another, it does mean that those events are a cause and an effect. A ball hits a ball and it moves; that is what we see, but it does not mean that we can infer that if next time a ball hits a ball it will move. All we see is nothing but a succession of events and if we infer that an event should follow an event because a similar event followed after a similar event, we can infer this, according to Hume, only for the reason of constantly observing this succession of similar events, that is, by custom. No properly logical inference can be made from our experience.

Suppose a natural law – may it be a law of mechanics, as it is the case with the ball hitting, or may it be, for the sake of example, celestial mechanics or any other law of nature; we cannot conclude from the instances of that law the appearance of its further instances. We cannot infer from the instances of a law or regularity the universality of this law or regularity. Thus, as it is often said, if we see that the sun rises every day, it does not mean that it will rise to-morrow. From the fact that all the previous instances of regularity or a law have been fulfilled we cannot even infer the fulfillment of the next instance of the regularity.

This brings about certain predicaments. If induction is not justified, the same may be said in particular about each law of nature ever be discovered, any regularity be noticed. Knowing a law, we at the same time do not know whether its instances will appear, whether or not it is still a law. If further instances are not guaranteed, the existence of a law may be asserted only with a risk. Moreover, without a risk we cannot call anything a law or regularity. It gives us a shaky and insecure picture of the world. In such a world, nothing can be determinately regular, perfect, and absolute. Nevertheless mainly, we do not regard our world as such.

Rather we regard it as stable and for the most part predictable. Its unpredictability is regarded as something secondary, something that ultimately should lead to predictability on another level (for instance, on the level of macro world) or something that we cannot predict for the reason of the imperfection of our methods. Thus, when we take a plane we

are worrying about reliability of its mechanisms but we are not worrying whether or not further instances of the law of gravity are held.

Actually we have great confidence in regularities that we have discovered, we apply what we have discovered to ingenious devices in which we are so confident that we can trust our lives in them; on the other hand, we have absolutely no guarantee that those regularities can repeat themselves further in our experience and in our practice. For Hume this confidence in what we cannot be logically justified but what we meet constantly in reality as repeating itself can be explained simply by the idea of custom – this confidence is induced by the custom to confront those repetitions in our reality as any custom may be understood.

The view of the world based on this confidence, on the custom, in Humean sense, and the view of the world that can be depicted considering the impossibility to justify induction contrast sharply. In the first view, we are to follow regularities that we happen to reveal, while in the second view we have to expect any moment that the regularities cease appearing or at least their appearance may be equally expected and not expected, no matter how long they have held. In the first view, the world is a place where all events are instances of a number of natural laws (a number of laws may be anticipated to be reduced to one law). The other view implies we should be skeptical about all regularities we learnt, for we have no sufficient ground to infer their universality. In one view the world is ruled by laws, in the other, it can be nothing but a set of events or objects, which may iterate and may not. But this is one and the same world.

Never being able to justify induction, we are, so to speak, in the position of someone who "knows" something of which he has no possibility to know. To know some regularities and to know how to use them does not mean to know that it must be so that the world is such that the iterating instances we observe are to iterate, that the regularities we know are not something contingent that only seem to be regularities while we observe them.

That it is impossible to assert that once we have observed some instances, we should infer the existence of further instances seems obvious. It is impossible to infer (not to suppose or guess) future events from the past events or present events. But it seems also that without some notion of induction we cannot get along with knowledge gained from experience. There are some attempts to provide the experiential knowledge with some idea of induction. One of the attempts is to regard induction (the inferences from single events) as probability. This seems natural, for instances of regularity to come may be assessed as coming with a certain probability if we know frequencies of their previous appearances. Thus, if

the sun rises every day, it has the highest probability to rise to-morrow and if some evidences have appeared that an animal changes its habits we should expect to observe its usual behavior with lower probability than ever. Because of lack of other plausible concepts of inferences from the particular the concept of probability proves to be consistent. For probability can correct itself. We can change the expected probability of an event if we confronted with frequencies of the appearance of the event that are different from what they were before or we have learnt another condition of its appearance. In this way, further instances get to be known through the previous instances; events to come may be "inductively" inferred through the events that have taken place. Self-correction of probability gives that which is inductive in our judgments on future events.

But probability statements are not categorical, speaking of the probability of something we imply mutually exclusive outcomes; to be probable means to include different results which do not appear together at once. Hardly is it accurate to mean any inference – of the kind that the notion of induction implies – when we speak literally about probabilities. To infer to the particular from the particular is not the same as to infer from the probable or to the probable. Besides, the notion of probability in itself is not uniquely defined. It has different definitions (or, as someone may prefer, there are different notions of probability). The definitions represent probability as subjective as to its basis, as resulting from the frequencies of events' occurrences, as propensity, as based on axioms and so on. Thus, if someone decides that probability acts as induction should do and wishes to turn, in a certain sense, the notion of induction into the notion of probability, he would not do a very good turn as to its simplicity.

It seems that the simplest and at present prevailing way to overcome the problem of induction is the Popperian one. It says that inductive inferences are at least superfluous or irrelevant in experiential knowledge because scientific hypotheses are not what is to be verified by experience, they are what is to be falsified. No number of instances corroborating a hypothesis can be a basis for the assertion of its being true. A hypothesis may be considered true just until instances contradictory to it are found. As to this view, experiential knowledge is deductive. Hypotheses are not and cannot be inferred from experience. They are made up by a man and refuted by a fact of experience, if at all, through the ordinary rule of modus tollens. If a hypothesis is that all swans are white, it may be refuted if we come across a black swan. It cannot be corroborated by referring to the fact that we have met only white swans. Hypotheses must be constructed so that it should be possible to falsify them by experience.

Thus, induction plays no role in our knowledge (scientific knowledge, as well as ordinary). Nobody succeeded in inferring the general from the particular. And we need not do it. All we are to do is to make conjectures and test whether or not data of experience match our conjectures. Of course, our conjectures must be liable to such tests. That is, a hypothesis must be about something that can be met in experience and must be such that the instances it is saying about may be construed, at least in the upshot, unambiguously either in favor or contrary to it.

The requirements to hypotheses that the concept of falsifiability supports are induced by the nature of our relation to experience, the experience from which we cannot infer universal empirical concepts. We cannot infer the general from the particular; hence, any number of instances cannot corroborate a hypothesis. And if any number of instances cannot corroborate a hypothesis, then we should refuse of corroborating it by instances that go with it and take the other option – we should establish that a hypothesis is corroborated when instances that are to test it do not clash it. Universal statements on experience are true not when it is tested whether they are true and turn out to be true, but when it is tested whether they are false and turn out to be true. If we tested whether they were true, even if they were really true, we could not say that they were true as such, as universal statements, because we cannot infer their truth from instances that corroborate them. For we cannot conclude something general from the particular instances, we cannot make inductive inferences. Therefore, we should content ourselves with checking whether they are false, trying to provide instances that would refute them.

That we are to falsify statements is the consequence of the impossibility of induction. It is what we have to do if we do not have at our disposal the inductive inference. Somebody whose tests whether something is true cannot be justified should test at least whether it is false. Suppose we have a universal statement on experience, that is, we have judged on something we observe that it is to appear from now on. And we know that no instance, which is in accord with this statement, can corroborate it, for we cannot infer universality from the instance. Thus, if we wish to assure ourselves that the statement is true, then our only option is to check whether or not we confront instances contradictory to it.

This way the concept of falsifiability returns us back to the problem of induction being itself a way to resolve it, a way that induction itself prompts.

Falsifiability is a harsher way to treat a hypothesis than verification, which, very roughly, consists in searching instances that correspond to a hypothesis in their peculiar way. To try to falsify a hypothesis means to

take a risk for it to be rejected. In experiments scientists bring about circumstances for the objects our hypotheses are about which could overturn the hypotheses. If the hypotheses survive, then other tests with other hostile circumstances are waiting for them. A hypothesis continues to hold if it survives under such-and-such tests and (or) such-and-such tests and only that far it is considered to be true. Better confidence in its truth requires further tests, ever new.

But let us take some single kind of tests. Scientists have to repeat the same test for a number of reasons: for better approximation, for assurance of the devices' reliability and so on. Suppose this test is successful and the hypothesis is proved, then can we be sure that the next of these repetitions of the same tests gives the same results as the previous tests? – Of course not. We cannot infer from the tests having been done that the next test will be the same as they are. We cannot do inductive inferences, no matter whether it concerns tests that are to falsify hypotheses or to verify them or confirm or whatever. And even if our way to corroborate our statements on experience, hypotheses, is not inductive, as it is the case with the concept of falsifiability, it does not mean that we have succeeded in resolving the problem of induction. It means only that we have a way to corroborate hypotheses that is not based on the concept of induction; that is, testing hypotheses we have not come to inductive inferences.

We cannot extirpate the problem of induction by swapping inductive inferences for deductive and verification or confirmation for falsification in the process of corroborating statements on experience. In so doing we can only circumvent this problem. There remains the fact that there is no nexus between instances of regularity, therefore we cannot infer a general statement from the particular protocol statements on the phenomena of experience. We may state that universal statements on experience must be falsified rather than verified; tests must be put on whether there are contradictory instances rather than on whether there are corresponding instances. But once a statement is tested, we have no guarantee that further similar tests will yield the same results, as well as we cannot guarantee further similar corresponding instances. The quest in which we are testing our theories has no end because no test can give us a guarantee of further repetitions of the results it brings no matter what kind of results it were.

We may find a more plausible way to corroborate hypotheses than that which has to rely upon inductive inferences, as it is the case with the concept of falsifiability that represents this more plausible way, but this way is that which concerns particular hypotheses, statements to be corroborated. Being disappointed with the validity of inductive inferences and introducing the concept of falsifiability (or even trying to reinforce

induction with the concept of probability), we by no means can give the answer to the question: If induction is not justified, then what gives the possibility to our knowledge? How we know that something may be known, if no regularity is guaranteed to be held? Considering the impossibility of inductive inferences, it turns out that we cannot answer this question at all, at least concerning our knowledge of facts of experience. All we can know about experience, having at our disposal the deductive inference and strictly not having at our disposal the inductive inference, is that such and such statements (or such and such hypotheses) have stood such and such tests, but we should not be molested with the existential questions about knowledge. For within the logical methods that are available it seems impossible to answer why knowledge is possible whereas no regularity can be guaranteed.

The question about the possibility of knowledge cannot be put and answered within our means; nevertheless, we can determine what we may know. If we cannot do inductive inferences and, hence, have to test statements on experience by looking for the instances that contradict them, we, as it was said, only know that certain assertions have stood certain tests and these assertions constitute the content of our view of the world. This view exists on the background of impossibility to justify inductive inferences. Therefore, these tested assertions cannot be generalized over further instances. We may say that we know, in strict sense, what these assertions are about in so far as they have been tested in the experiments that have been done. It must be realized that further experiments can overthrown the assertions – impossibility of induction points out that further instances of what the assertions is about may turn out wrong and further tests that are to falsify them may succeed. If they succeed, if certain assertions of which consists our view of the world are refuted, then this view is changed, sometimes it is changed radically.

In the upshot, if the appearance of further instances of regularity were guaranteed – let us suppose for a while such a fantastic thing – then we could not speak about any changes at all, we had a stagnant, totally predictable world. But we have not such a guarantee. The impossibility of inductive inferences concerning further instances of regularities makes it possible that regularities change or disappear. If our world is predictable (there are regularities we revealed), it is predictable under serious reservation of lack of guarantee for the appearance of further instances.

Thus if we are going to describe the world and we wish to take for the basis something more reliable than the regularities, all suspended as true until refuted by further tests, we must describe it simply as instances that already happened but that are essentially nothing but instances. We must

describe it as events which may or may not fall under certain regularity. The fact that induction cannot be justified allows us to look at the world as a sequence of events (or a succession in the sense of Hume). This view of the world resembles to the *Tractatus* concept of the world that represents the ontology of facts. The world consists of facts (or events) and hence any generalization concerning iterating events is contingent, inessential in such a world; in this world, generalizations cannot be justified properly. No matter which fashion we take on for these generalizations (empirical universal statements, hypotheses) to be corroborated (this may be falsification, verification, confirmation), iterating events (if at all) of which these generalizations speak about are always on a par with miscellaneous events of which this world (as it is deemed) essentially consists. This is, so to speak, the problem of induction exposed in ontological terms. It is peremptory and far less clear exposition (if we take it at all for an exposition) of this problem, but it helps to understand what a world it might be (of course, it might be otherwise, either) if it is understood within our knowledge be deprived of inductive inferences.

The world – at least, as it is guaranteed to be by our knowledge that cannot guarantee to us further instances of regularities that we observe (the world being only such as it is represented to be by our knowledge – knowledge without inductive inferences) – is the world of single objects and single events and single appearances of objects and events. We can state only that there took place such and such event and there is such and such object with such and such properties, but we cannot state justifiably that such and such properties and such and such events must be generalized over any objects that are to be. This is the world of what is observed. We protocol the observations and refer to them speaking about the real world. If we assert that the world is such and such laws and regularities, we assert too much, for regularities, laws are the generalizations over facts and events that are to come but not yet protocoled.

Hume's skepticism, at least tacitly, remains us a possibility to speak about the world as of what is observed; we are allowed recognizing that as reality. Cartesian skepticism does not permit even this. Cartesian skepticism says that there is no proof that what is observed is reality. The world that we observe, we have in our senses, may well be an illusion, a dream, delirium but not necessary reality, as we use to call it. One of the latest versions of that skepticism asserts that all that we feel, think, remember, sense, perceive anyhow is nothing but representations, induced by electric impulses given to our brain by alien scientists, while our brain is floating in a vat somewhere on a remote planet in an alien laboratory. We have no

proof that things are otherwise. Thus, we do not know and cannot know whether the world is our world or something very different from it, or any world at all. Traditionally Hume's skepticism is regarded as sending a challenge that is more serious to scientific knowledge than Cartesian skepticism, for it deals with laws and regularities but not with evanescent sensations. Thus, let us try to make the world totally disappear adhering only to Hume's skepticism.

Suppose now, in the remote future, a virus, which deprived people of all senses, inflicted the human race. We all lose sight, ability to here and so on. The disease had been aggravated by unfavorable changes in climate and pollution and as the result, the disease became genetic, everyone were born without sight and hearing. The human race irreversibly turned into mutants lacking senses. Luckily enough, people managed to invent a device that if inserted in their brain could act as their senses would do. Each newly born mutant undergoes the operation of inserting this mutants' device and retrieves his faculties therefore (being compassionate, we may suppose the mutants' device endows them with better senses than usual human senses; with the sight of eagle and so on). The mutants' device is constructed in accordance with physical laws well known to the mutants. But they forgot all concepts of skepticism and consequent concepts from which they could guess or learn skeptical concepts. Then, how a mutant philosopher could represent for himself the problem of induction? (We suppose that the mutants are on earth, living in our actual world, with our logic, mathematics, physical laws and so on; we differ from them only by our senses, which are natural unlike their ones, but which are restored artificially).

A mutant philosopher, despite that he is "looking" through his mutants' device, should judge of the regularities and laws in the same way as our philosopher (that is, as Hume should do). As Hume did, he should not find any justification of universal statements on events, for he has the same logic as we have and he cannot infer the universal from the particular or the particular from the particular. With all his good artificial view, he cannot recognize that if the sun has risen to-day, then it must rise to-morrow – he only can recognize that it has risen to-day. For the mutant philosopher, as well as for Hume, there is only a succession of events; he cannot say that an event that happened first is the cause of the event that happened afterwards. He cannot say that regularity or a law that has taken place up to now is guaranteed to take place further.

But the mutant philosopher also realizes that on a par with laws of nature whose instances he observes through his mutants' device, there are also laws which constitute the principles of work of this mutants' device.

He knows that there is no guarantee that these laws, which form the basis of his device's work that allowed him to make his observations, will take place further. Whatever he has observed, each observation he protocoled in any way, is due to some instances of laws that represent the principles of the device's work. He knows that the appearance of their further instances is not guaranteed. Hence, for him the world is not something that may be described with a concept like the ontology of facts. Unlike Hume, he cannot leave untouched the question of objects or events whose belonging to regularities is not guaranteed. His view of the world cannot contain a collection of facts or events or objects that are to be accumulated and that are regarded as that from which it is impossible to generalize. For the mutant philosopher appearance of those facts, events, objects in a collection is as not guaranteed as their further appearance as instances of regularity. Any fact or object, no matter whether it appears as appertaining to regularity or is separate, whether it is regarded as a cause or an effect or not, appears as such only through the device that is made in accordance with certain regularities, which, as such, we cannot guarantee to hold further. Hence, the very existence, further existence, of facts and objects that he learns through the device is not guaranteed, too. While Hume restrains himself from assertions on the existence of regularities of objects that are to appear, the mutant philosopher must restrain himself from assertions on the existence of objects to appear as such. Hume's skepticism refuse to state that things should be only of definite kinds, the skepticism of mutant philosopher refuse to state that they should be of definite substance – they may not only do not fall under this or that regularity, they may not even exist and follow in succession (as they do in their existence) one after another as such (simply as objects, events). For Hume there is only a succession of events – at best, they are organized in a succession; for the mutant philosopher there may not be even the succession or any succession for lack of further members and not only any link between any members. Hume, once having observed the appearance of one object immediately after another, rejects that the existence of one object is inferred from the existence of another. The mutant philosopher, once having observed the appearance of one object, rejects that from this fact it can be inferred that he can observe the appearance of another object (if at all) – at least on the same terms as the first one was observed. This is somewhat stronger skepticism.

In the upshot, if you perceive everything through a device based on regularity and you know that any regularity cannot actually provide any nexus between its instances, you infer that there is no nexus between any instances. You cannot say that anything in the world has a nexus with

anything else. In that case, you cannot regard the world as something whole (you cannot regard the world as a world, so to speak). The world, in that case, is nothing but separate events that cannot follow one from another, for the regularity on which basis we perceive every event cannot (as well as any regularity) provide any link or nexus between its instances and, hence, between the instances (between the events or objects) which we perceive with its help. This skepticism is more general. If you have got regularity (or a number of regularities) that represents a basis to perceive everything you perceive, then on the ground of this regularity you may judge of everything. Namely, in that case, we are able to conclude that our world (at least the world where the mutant philosopher lives) is not a world properly because its constituent parts (whatever they might be: facts, objects) have no connection between each other. This requirement for the world is of principle. This lack of connection implies lack of anything definite or peculiar. Thus, if we speak of the world in terms of the ontology of facts, implying that the facts is what makes the world be the whole or is what allows us to speak of it as a whole, then we do not speak of the world totally without any nexus (the world that should not be regarded even as a world).

Hume regarded the fact that we unjustifiably infer the appearance of one object from the appearance of another object as a custom, a habit. We have no ground to ascribe relations of cause and effect, properties that make them interact, or any sort of connection between them to these objects, the objects we observe. Thus, we have to put it down to the mind, not to the real objects, that instead of affirming only that which is observed, that is, that one object follows another, we are (erroneously) making inferences from the objects. We do it by custom simply because the objects, of which we are making inferences, iterate.

The mutant philosopher knows that all events observed through his device are (or somehow correspond to) the instances of the laws constituting the principles of the device's work. Since there is no nexus between the instances of those laws, there can be no nexus between anything in the world. Thus, for the mutant philosopher the world is nothing but a turn of speech. He does not take for serious any unity (not to mention any connection in Hume's sense) of all he ever observes, not even the unity of all only as a succession of objects or a simple collection of facts or whatever.

But is it necessary to be deaf and blind to refuse regarding the world to be the whole? If we are not so distressfully handicapped as the mutants are and not so advanced in science and technologies, can we understand the impossibility of induction in the way they do? (In other words, are we

mutants in a sense?) It seems that that we cannot regard the world unique as a substance is a natural consequence of the rejection of induction.

A number of physical laws show the way our senses are built – they are built in accordance with what those laws allow and what those laws restrict. As it is the case with any regularity, repetitions of their instances cannot be guaranteed. Hence, the appearance of what we can get through the senses is not also guaranteed. Being convinced that we cannot infer the appearance of one object from the appearance of another object, we have to determine that it would be better to describe the world as those objects, each with its properties, or as facts. But all that is what we have in the senses and we cannot guarantee that those objects (physical objects, as we are convinced) or facts cannot turn out to be something different.

For the very reason that we cannot guarantee further instances of a natural law, we cannot conclude, in particular, from the fact that the sun rose today, that it will rise to-morrow. And if our senses and thinking act in accordance with natural laws, we cannot conclude from our verisimilar and seemingly most reliable representation of the world – the representation that does not imply any inference from the particular, the representation of the world as the world of facts – that it is really is the world of facts. It may turn out to be a delirium or dream. If we cannot infer from the particular, then we cannot infer that the sun will rise to-morrow, and we cannot infer that next moment we will not get a strong evidence that we are (and always have been) nothing but a brain in a vat or anything else of the same sort or of whatever sort.

It seems that if our knowledge of human body and brain were more advanced, say, to the extent we could commonly change the terms that we use talking about sensations and thoughts for scientific terms designating accordingly body and brain processes, it could not occur to anybody that Cartesian skepticism and Hume's skepticism could be different concepts.

The impossibility of inference from the particular makes us unable to answer the question: Why the empirical knowledge is possible? We just have no means to determine the possibility of knowledge itself. We may only account as a success or account as not a success of some statements put to some definite tests. Those statements may turn out to be true or false on further tests but it does not help to answer this question or the question: Whether knowledge is possible at all? And it does not guarantee to any degree that all we regard as known may not turn out to be a delirium or that a next instance of regularity we count as known may not hold.

We do not know whether knowledge is possible but we also do not know knowledge of what is to be possible. Realizing that we cannot infer

from the particular, we, in the upshot, have lost that about what our knowledge is supposed to be.

Instead of speaking about the world, whereas implying that to describe the world is tantamount to establishing laws and regularities according to which it exists, we have to be content with registering distinct phenomena (objects or events), having to forget about representation of the world as the whole to which the regularities is the basis, no matter how impeccably our hypothesis about the world‘s laws matches those phenomena. However, it does not mean that if we cannot understand the world as regularities, we could understand it just as that which constitutes the content of the regularities. It might be as well not the objects or events we observe, it might be anything. Even the flow of anything what happens is not necessary that which is to remain itself.

CHAPTER TWO

"SKEPTICAL PHYSICS"

If we are looking at our physical world through our logic, we realize that our cognition is seriously limited. We cannot generalize any regularity even if there was never any exclusion out of this regularity. We cannot even fully recognize that our world is the world of physical objects or the like or whatever substance it might be of.

But is that really of importance for the cognition as it is, not as it is to be from the point of view of our logic, to be justified logically? Our logic says that from the existence of an object does not follow the existence of another object, from the existence of objects does not follow their further and trustworthy existence. But, in the upshot, that our logic is such and such does not entail that the world must be in total accordance with it. We might allow it that to certain extent logic might not correspond to the real world. The fact that empirical knowledge is not justified does not influence on the process of cognition. We accumulate knowledge through our observations of the world. We propound hypotheses. Some of them stand tests and for that reason, we consider them as true and assume that their content constitutes our knowledge of the world. Some of them do not stand tests and we know therefore what our world is not. If we look at things this way, the way of common sense and usual practice, then, some might say, knowledge that is acquired allows us to develop technologies and challenges logic, if logic has no inference to justify that, but it is not logic that challenges scientific knowledge.

Commonly this is a prevailing view. It implies that the empirical knowledge acquiring is that which supports our reason; our judgments need to be upheld by empirical data. Our reason that is not supported by empirical knowledge may raise doubts of the justifiability of the way laws of nature may be established and even of the existence of physical objects themselves, that is, of the world itself as scientific knowledge represents it to be, but this bears evidence only in favor of the conclusive assertion that our reason is helpless without the experience.

This view may be looked upon as something like official it is long since (since more than two centuries ago). Those who support this view

realize that it allows us in some sense to leave the problem of induction untouched. But if we take on the way of experience as opposed to the way of reason, can we also avoid doubts of the existence of physical objects as they are raised in Cartesian skepticism and as it may be the case with Hume's skepticism in its extended version as we exposed above? If we are trusting only experience, is the impossibility of inductive inference the only trouble we meet or we may encounter something pretty skeptical that is brought about by our experience itself?

We cannot justify further instances of our laws; we deduce from it that we cannot justify the existence of physical objects whose perception is depending on certain physical laws. But is this the only trouble with experience or there may experiments be met, that can be construed as "skeptical", the experiments that put limits to our knowledge instead of enlarging it? If we met such experiments, our skeptical doubts could probably turn out to be of another character than of purely logical. Probably we could refer to the real world as to that in which what makes us restrain from universal judgments and judgments of, so to speak, too obvious observations is inherent.

It is easy to recall the experiments of the kind. It may be stated that these are the experiments that test to the relativity theory and, in particular, special relativity. Special relativity is just the theory that is based on the experiments of the kind.

This theory has as one of its fundamental propositions the constancy of the velocity of light. Light travels with the same maximum speed within any system of inertial coordinates. This means that a ray of light should move with the same speed regardless of the motion of its source. If the source of a ray of light is on a carriage that passes by an embankment with an observer, then the observer will record the speed of the ray as it is on the carriage (the constant speed of light) but not the constant speed of light added to the speed of the carriage. In all frames of reference one can record only the same speed of light; it is somewhat less than three hundred thousand kilometers a second (or c). If someone uniformly moves relatively to anyone else and emit a ray of light, the maximum speed of this ray is the same regardless of the place it may be measured, the one who moves relative to him records the same speed as the other one does. And if someone moves with any speed, including the speed of light, and emits a ray of light, the speed of this ray will remain the same; not more than c. This speed cannot be exceeded within any frame. These facts are known from experience and the existence of the maximum velocity of the propagation of light put a certain limit to our knowledge. Speaking about our knowledge of physical world, we should speak about only of what we

can observe, generally, within the limits of the speed of the propagation of light.

But when we talk about experiments putting, in some sense, limits to our knowledge, we should talk about the experiments that concern special relativity in general, not only those concerning the velocity of light in all frames. For special relativity has the concept of the velocity of light as its constituent part and one of its bases, and we must regard the experiments testing special relativity as experiments limiting knowledge in a sense. Special relativity is, roughly, a consequence of the postulate that light in vacuum travels with the constant velocity, c, in all frames regardless the state of motion of its source. This is the second postulate. The first postulate dates back to Galileo. It is the principal of relativity and it says that the laws of physics are the same for all observers in uniform motion relative one to another. (Usually this is put in another way. The assumptions of relativity and light speed invariance are compatible if relations of a new type, that is "Lorentz transformation", are postulated for the conversion of coordinates and times of events. Thus, the postulates of the special theory of relativity may be reduced to the principle: The laws of physics are invariant with respect to Lorentz transformations (to the transition from one inertial system to any other arbitrarily chosen inertial system)). This represents, in a sense, a restricting principle for natural laws. Equivalently, it may be said that the theory is based on the postulate of Minkowski space-time.

Even if one does not know what is Lorentz transformations, but he just knows that laws of physics are equivalent in uniform motion in all frames and knows that whatever a frame one chooses he cannot record the speed that exceeds the speed of light, even in that case – if he has no idea of mathematics of Lorentz transformations – he must suspect that the constant c should bring about changes for things that are in the frames for which c is a constant.

If the biggest possible speed is the same no matter from which position it is recorded, then, in order to keep that maximum speed c to be the same in all frames, distance or time lapse must be altered. Thus, if one observer moves relative to another observer, his time runs slower than the time of the observer relative to whom he moves. The famous "twin paradox" says that a twin who flies off in a spaceship traveling near the speed of light returns to discover that his twin sibling has aged much more. And if one observer moves relative another observer, the length of an object as measured by him may be smaller than the results of measurements of the same object made by the other observer. This concerns any dimension and contraction takes place only in the direction parallel to the

direction in which the observed body is traveling. Thus, if the direction of the movement is parallel to the height of an object, the object becomes smaller.

An observer who moves receives two signals (rays of light running in opposite directions to the mid point) simultaneously in his own frame of reference. But from the point of view of an observer at rest, the signals do not come at the same moment; for him the signal that runs opposite to the direction of movement should come earlier because, as he sees, the moving observer goes toward the ray. Hence there is no absolute simultaneity. Two events happening in two different locations that occur simultaneously to one observer may occur at different times to another observer. Every frame of reference has its own particular time; unless we are told of the frame of reference to which the statement of the time refers, there is no meaning in a statement of the time of an event.

We cannot simply add velocities as the arithmetical operation of addition would require. If a rocket is moving with a speed which approximates to the speed of light and it launches another rocket whose speed is comparable with it, then the speed of this launched rocket cannot be the sum of its own speed and of the rocket that has launched it. The speed of the second rocket is calculated according to a formula derived from the formulas of space and time transformations (naturally, speeds that are much lower than c are to be calculated in the same way, not by addition, if the calculations must be precise).

The mass of a body from observer’s point of view is increasing as the speed of the body approaches the speed of light. The faster the body moves the more difficult it is to accelerate it. To an observer who is not accelerating, it appears as though the object's inertia is increasing, so as to produce a smaller acceleration in response to the same force. This behavior is in fact observed in particle accelerators. The mass of an object is proportional to its energy.

Among the consequences of special relativity there is also the following. Suppose there is a frame of reference in which event A and event B occur simultaneously, separated only in space. However there are also frames in which A precedes B and frames in which B precedes A. If it were possible for a cause-and-effect relationship to exist between events A and B, then paradoxes of causality would result. For example, if A was the cause and B the effect, then there would be frames of reference in which the effect preceded the cause. Thus, in order causality to be preserved, no information or object can travel faster than light. One can show that faster than light signals can be sent back into one's own past. A causal paradox can then be constructed by sending the signal into the past.

That it is impossible to travel faster than light can be immediately observed in accelerators when, for instance, the force applied to a particle augments its mass and makes it more difficult to accelerate it.

With its postulates that the speed of light is the constant for all frames, while laws of physics are the same in uniform motion, and with its consequence that it is impossible to travel faster than light, special relativity is one of the keystones of physics. Simply physics could not be what it is without the notion of the maximum speed with which any information can be transmitted. Special relativity has its generalization for accelerating frames in general relativity and it is an organic part in such all-comprehensive theories as quantum field theory and string theory. Modern accelerators (as well as other research devices) where postulates and consequences of special relativity are tested are, naturally, themselves cannot be built otherwise but on the principles of special relativity. Beside that, many experiments corroborated the basis of the theory and its diverse consequences immediately. Starting from the famous Michelson-Morley experiment that was conducted, naturally, without intention to prove or overthrown the theory (it just independently gave support to the postulate showing that the detecting an absolute reference velocity was unachievable); there were a number of experiments to test special relativity against rival theories. Thus, for instance, Kennedy–Thorndike experiment was conducted as a modified form of Michelson-Morley procedure and unlike Michelson-Morley experiment, it had as its purpose to test special relativity. Many experiments were conducted on purpose to test the theory and many results that corroborate the theory were obtained routinely in experiments that were not conducted with intention to test the theory. Finally, it was recognized that special relativity is experimentally tested to extremely high degree of accuracy.

Tests that are to corroborate (or overthrown) the thesis that light travels with the same speed in all frames (for instance, the experiments that test whether the speed of a ray of light depends on the speed of the emitter of that ray), naturally, must be regarded as tests that are to corroborate all consequences of this thesis. If we test the postulate of the constancy of the maximum velocity in all frames, therefore we test time dilation and length contraction, the impossibility to transmit information faster than light and so on. And in reverse, experiments that, for instance, are to test whether or not there are time dilation or length contractions actually test whether or not the speed of light does not exceed c in all reference frames. The postulate of the constancy of the maximum speed in all systems of coordinates is that which changes the world if we had a view of the world where the postulate was not considered (this really took place before the

discovery of relativity). A characteristic of a signal with whose help we obtain our knowledge of the world determines the world itself. This characteristic reaffirms its universality when generalized for accelerating frames in general relativity – in special relativity it is valid for inertial frames that do not concern gravity.

General relativity describes the gravitational field. This theory equals gravitational and inertial masses. This means that bodies that are accelerating and bodies that are just in the gravitational field are in identical positions from the physical point of view. In the upshot, it allows us to consider free fall as inertial motion. That is, a body in free fall is falling because that is how bodies move when there is no force being exerted on them. While in classical mechanics this motion is due to the force of gravity, in general relativity the space-time of special relativity is curved. Otherwise, these two theories would contradict each other. For in special relativity inertially moving bodies cannot accelerate with respect to each other, but bodies in free fall do so. Thus, because of the idea of curvature, general relativity is the geometric theory. Gravity in general relativity is just a property of the space-time of special relativity. This way it unifies special relativity and Newtonian physics. Mathematically it is represented as a set of ten differential equations, field equations, in which the fundamental force of gravity is described as a curved space-time caused by matter and energy. The curvature is resulting from matter and energy and is determined by the use of those equations.

In general relativity, by virtue of equivalence principle – that is, the postulate that the state of accelerating body is equivalent to the state of it in gravitational field – gravity must influence the pass of time. Thus, there is an effect known as gravitational time dilation. Processes close to a massive body run more slowly when compared with processes taking place away from it.

General relativity also predicts that the path of a ray of light is bent in a gravitational field. Light passing near a massive body is deflected towards that body. For in curved space light travels not along the straight line but along what is the generalization of the straight line for curved space (that is, along geodesic) the shortest path between points on the curved space. Such geodesics are the generalization of the invariance of the speed of light in special relativity. The deflection of light by gravity is responsible for an astronomical phenomenon known as gravitational lensing. If a massive object is situated between the astronomer and a distant object with appropriate mass and relative distances, the astronomer will see instead of one image of the object multiple distorted images of the object. The frequency of light waves is also dependent of gravity. Thus, light wave